# Mapping the most problematic functions in chronic low back pain patients: Analysis of the patient-specific functional scale

Mapping the most problematic functions

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**Abstract**

Aim: Difficulty in functioning is one of the reasons by patients with low back pain (LBP) seek help. The purpose was to identify the problematic functions of chronic LBP patients using the Patient-Specific Functional Scale (PSFS) based on the International Classification of Functioning, Disability and Health (ICF) and investigate the related factors with the PSFS scores.

Material and Methods: One-hundred LBP patients were included. The responses obtained from PSFS were linked to the ICF categories based on the linking procedure. Patient reported outcome measures (PROMs) and physical measurements were used for clinical assessment. Correlations were analyzed with Spearman's rho correlation.

Results: The identified 327 meaningful concepts were linked to 28 different 2nd level and 40 different 3rd level ICF categories. PSFS was found to correlate with the pain level during activity, perceived disability, and some domains of the health-related quality of life (p<0.05), while kinesiophobia and emotional status did not correlate with PSFS scores (p>0.05). Among physical tests, flexibility measurements correlated with PSFS scores (p<0.05).

Discussion: Chronic LBP patients reported various functions. The content analyses showed the need for an extension of the ICF core sets for LBP. This study also revealed that not all PROMs and physical outcomes are able to reflect the difficulty level of the problematic activities. Assessment with PSFS may be beneficial for individually tailored treatment programs.

**Keywords**

Low Back Pain, ICF, PSFS, Rehabilitation

## Introduction

Low back pain (LBP) is a major disabling pathology. The number of people with LBP in 2017 was 577.0 million and the researchers predicted an increase in the future [1].

The literature supports that the patients suffer from pain, muscle weakness, activity limitations, interruption of daily activities, psychological manifestations, sleep problems or work loss [1]. While these researches provide an overview of the disturbances at the population and individual levels, they do not specify the most important problems for daily life for LBP patients.

Exercise therapy is a part of the conservative treatment of LBP and is superior to passive modalities. However, there are some barriers to doing exercise in chronic musculoskeletal conditions. To improve the exercise adherence of patients and the efficiency of the treatment program, patient-based views are valued instead of purely clinician-based opinions. In this sense, the evaluation of the patient's experience of functioning may be beneficial in the selection of exercises in line with the patient's preferences and abilities [2]. Even though, there are fixed-item structured back pain-specific questionnaires, their ability to capture patients' functioning experience remains unclear [3].

Patient-Specific Functional Scale (PSFS) is a patient-specific scale, which focuses on the difficulty of performing functional activities that patients have problems or are unable to do due to disorder. The scale provides a patient-centered assessment of the current state of the problematic activity and improvement of limitations in activity over time. It also allows for setting personal goals for treatment plans and evaluate treatment interventions. PSFS has been developed by Stratford et al., (1995) and found valid and reliable instrument in chronic LBP [4,5].

The International Classification of Functioning, Disability and Health (ICF) is the World Health Organization's biopsychosocial framework for health and disability used to classify and compare health information [6]. The ICF describes a person's health and experience of health within different components and provides a universal language for the description of disease-related assessments among professionals. ICF linking rules have been defined to extract the content of the different patient reported assessments, including PSFS, into ICF categories [7].

The primary aim of the present study was to identify the important functional problems among individuals with chronic LBP and link these contents with the ICF. The second aim was to investigate the related factors with the PSFS in patients with LBP.

## Material and Methods

One hundred patients with LBP, who applied to our department, were recruited between December 2022 and February 2023. The inclusion criteria were being 18 years or older, having LBP for at least 12 weeks, and voluntary participation in the study. Patients who needed surgery due to LBP, who had systematic, cardiac, rheumatological diseases or generalized pain, who had spine surgery and were pregnant were excluded from the study. The study was approved by the institutional ethics committee (ref:23.02.2023/28). Informed consent was obtained from each participant.

*Patient Assessments*

Patient Specific-Functional Scale (PSFS) is a patient-specific instrument that focuses on activity limitation in patients with musculoskeletal disorders. Kafa et al., (2022) stated that PSFS had good test-retest reliability in patients with chronic LBP [8]. The participants were asked to identify 3 functional tasks they were having trouble doing due to their current condition. The severity of each defined problem was scored between 0 (unable to perform) and 10 (able to perform pre-injury level).

Perceived pain levels during activity and at rest were registered using the Numerical Pain Rating Scale (NPRS), which provides a subjective measurement of pain intensity from 0 (no pain at all) and 10 (worst pain imaginable) [9].

LBP-related disability levels were evaluated by the Oswestry Disability Index (ODI), which evaluates different aspects of function. The Turkish version of ODI has excellent test-retest reliability [10].

The Turkish version of Health-Related Quality of Life Short Form 36 (SF-36) was used to assess the quality of life. SF-36 evaluates eight concepts of health. The total score was obtained by using the standard algorithm [11].

Tampa Kinesiophobia Scale (TKS) was used for kinesiophobia assessment. TKS contains 17 items, and higher scores indicate more severe kinesiophobia. The test-retest validity of the Turkish version of TKS was found excellent in neck and back pain patients [12].

Hospital Depression and Anxiety Scale (HADS) was used to investigate the anxiety and depression state of the patients. The scale consisted of two subscales of anxiety (HADS-A) and depression (HADS-D) [13].

*Physical Measurements*

Flexibility was evaluated by the finger-to-floor test and the lateral side bending tests. Static endurance was assessed by the Sorensen test, the trunk flexor endurance test and the lateral bridge test.

*Finger-to-Floor Test:* The patients bend forward without bending their knees while standing on a high platform and reach the floor with fingertips. The distance between the fingertip and the platform was measured [14].

*Lateral Side Bending Test:* The patients bend laterally their body as much as they can by sliding their hands on the thigh while standing with their arms next to the trunk. The distance between the start and final position of the third finger was measured [14].

*Sorensen's Test:* While the patient was in the prone position, with the pelvis, hips and knees secured on the table, he extends his upper body straight forward from the table. The time spent in a straight position is recorded [15].

*Trunk Flexors Endurance Test:* The patient was seated with the trunk flexed at 60°, both knees and hips flexed 90° when the examiner held the toes. The time during which the patient maintained the body position was recorded [15].

*Lateral Bridge Test:* The patient is placed in a side lying position, he lifts his body, resting on the forearm and toes on the dominant side and keeps this position as long as possible. The test ended when the straight position was lost [15].

## Data Analyses

### ICF Content Linking

The content consisting of participants' responses to PSFS was linked to ICF categories based on the established and refined rules [6]. The actual meaning of the information to be linked was identified. The meaningful concepts are linked to the most appropriate ICF category (second and third levels). When a response contains more than one concept, each concept has to be linked separately.

The two physical therapists who studied the ICF linking rules with online resources provided by the ICF Research Group carried out the linking process independently. A third physical therapist with ICF experienced was available in case of any disagreement, however, this was not required.

The agreement level of the linking of concepts at the second ICF category level was calculated with the Cohen's Kappa coefficient.

### Statistical Analyses

The 11.0 version of the "IBM SPSS (Statistical Package for Social Science) for Windows" statistical program was used. The normality of variables was tested by the Kolmogorov-Smirnov test. The descriptives of homogenously distributed data were reported as mean±standard deviation (SD), while the others were expressed as median and interquartile ranges 25/75 (IQR25/75). Spearman's rho correlation analysis was used for the correlations. The significant level was set at $p < 0.05$.

### Ethical Approval

Ethics Committee approval for the study was obtained.

## Results

### Patient Characteristics

One-hundred patients (76 females) were included in the study. The mean age was $37.18 \pm 9.16$ years and the mean BMI was $26.64 \pm 5.07$. The patients' characteristics based on the clinical measures are shown in Table 1.

### Reported Problems

All meaningful concepts within the PSFS responses were taken into consideration regardless of the severity of the problem. A total of 327 meaningful concepts were extracted and linked to the ICF. Percentage agreement was calculated using the Kappa coefficient and was found to be 0.840, suggesting a strong inter-rater agreement [16].

Of the 327 identified concepts, nearly all (%93,1) of the concepts were linked to the activity and participation component. Table 2 presents twenty-eight different 2nd level and forty 3rd level ICF categories from 10 different chapters (neuromusculoskeletal and movement-related functions (b7), learning and applying knowledge (d1), general tasks and demands (d2), mobility (d4), self-care (d5), domestic life (d6), major life areas (d8), community, social and civic life (d9), products and technology (e1), structures related to movement (s7)).

The nomination times and frequencies of all the second and third-level categories derived from the PSFS responses are demonstrated in Table 2. The most frequently reported second-level categories were: maintaining a body position (d415-18,3%), changing basic body position (d410-17,7%), lifting and carrying objects (d430-11,9%), doing housework (d640-11,6%).

**Table 1.** Clinical assessments of the LBP patients.

| | Median (IQR 25/75) | SF-36 Domains | Median (IQR 25/75) | | Median (IQR 25/75) |
|---|---|---|---|---|---|
| NPRS (rest) | 5 (2/6) | Physical functioning | 65 (45/85) | Finger to floor (cm) | 12 (3/20) |
| NPRS (activity) | 7 (5/8) | Role limitations due to physical health | 50 (0/75) | Lateral Side Bending Test (right) (cm) | 15 (12/20) |
| ODI | 24 (14/37.77) | Role limitations due to emotional problems | 33.30 (0/66.70) | Lateral Side Bending Test (left) (cm) | 14 (12/19) |
| TKS | 41 (38/44) | Energy/ fatigue | 45 (30/60) | Lateral Bridge Test (sc) | 12 (4/25.25) |
| HADS-A | 8 (5/10) | Emotional well-being | 60 (48/72) | Sorensen Test (sc) | 14.50 (8/29.75) |
| HADS-D | 7 (4/9) | Social functioning | 75 (50/87.5) | Modified Push-up Test | 7 (3/12) |
| PSFS item1 | 3 (2/5) | Pain | 45 (22.50/67.50) | Sit-up Test | 7 (3/12) |
| PSFS item2 | 3 (2/6) | General health | 50 (40/60) | | |
| PSFS item3 | 4 (2/6) | Health change | 50 (25/50) | | |
| PSFS average | 3.66 (2.33/5.33) | | | | |

(IQR 25/75) Interquartile Range 25/75; NPRS: Numeric Pain Rating Scale, ODI: Oswestry Disability Index, TKS: Tampa Kinesiophobia Scale, HADS-A: Hospital Anxiety and Depression Scale-Anxiety, HADS-A: Hospital Anxiety and Depression Scale-Depression, PSFS: Patient-Specific Functional Scale, SF-36: Health Related Quality of Life Short Form 36

Cleaning living area (d6402-10.4%), carrying on shoulders, hip and back (d4303-9.5%), maintaining sitting position (d4153-8.6%), maintaining standing position (d4154-8.6%), bending (d4105-7.6%) were the most frequent stated third level categories.

### PSFS Correlations with Clinical Measurements

The pain level during activity was negatively correlated with the scores of each item of PSFS ($p < 0.05$), while the pain level at rest was not correlated. There was a weak relationship between the ODI scores and PSFS scores ($p < 0.05$). No significant correlation was detected between the PSFS and TKS, HADS-A and HADS-D scores ($p < 0.05$) (Table 3).

While significant relationships were found between the PSFS and flexibility measurements ($p < 0.05$), PSFS scores did not correlate with static endurance test results ($p > 0.05$) (Table 3).

## Discussion

The present study investigated the most problematic functions in patients with chronic LBP by using PSFS and their relation to the ICF. The results demonstrated a range of important problems based on patients' responses. There are low to moderate correlations between PSFS and clinical outcomes.

The framing of the content in the PSFS reflects a mostly descriptive performance perspective, and all responses obtained by using PSFS were linked to ICF. Self-reported functional problems of chronic LBP patients in this study were consistent with the ICF model. The results provide evidence that PSFS is able to reflect the activity and participation component.

Turkish patients indicated some additional categories that were

**Table 2.** ICF-linked responses derived from PSFS.

| ICF Code - ICF Category Label (second level and third level) | Total Nomination times and frequency (%a) | ICF Code - ICF Category Label (second level and third level) | Total Nomination times and frequency (%a) |
|---|---|---|---|
| d410 Changing basic body position | 58 (17.7) | d455 Moving around | 23 (7.0) |
| d4105 Bending | 25 (7.6) | d4551 Climbing | 21 (6.4) |
| d4100 Lying down | 10 (3.1) | d530 Toileting | 2 (0.6) |
| d4103 Sitting | 7 (2.1) | d540 Dressing | 9 (2.8) |
| d4104 Standing | 12 (3.7) | d5400 Putting on clothes | 6 (1.8) |
| d415 Maintaining a body position | 60 (18.3) | d620 Acquisition of goods and services | 11 (3.4) |
| d4153 Maintaining a sitting position | 28 (8.6) | d6200 Shopping | 11 (3.4) |
| d4154 Maintaining a standing position | 28 (8.6) | d630 Preparing meals | 2 (0.6) |
| d4150 Maintaining a lying position | 4 (1.2) | d640 Doing housework | 38 (11.6) |
| d220 Undertaking multiple tasks | 3 (0.9) | d6402 Cleaning living area | 34 (10.4) |
| d230 Carrying out daily routine | 3 (0.9) | d650 Caring for household objects | 5 (1.5) |
| d430 Lifting and carrying objects | 39 (11.9) | d660 Assisting others | 1 (0.3) |
| d4303 Carrying on shoulders, hip and back | 31 (9.5) | d920 Recreation and leisure | 1 (0.3) |
| d4300 Lifting | 5 (1.5) | e225 Climate | 2 (0.6) |
| d435 Moving objects with lower extremities | 1 (0.3) | d129 Purposeful sensory experiences, other specified and unspecified | 1 (0.3) |
| d449 Carrying, moving and handling objects, other specified and unspecified | 1 (0.3) | d710 Basic interpersonal interactions | 1 (0.3) |
| d450 Walking | 23 (7.0) | d845 Acquiring, keeping and terminating a job | 3 (0.9) |
| d470 Using transportation | 8 (2.4) | e135 Products and technology for employment | 3 (0.9) |
| d4702 Using public motorized transportation | 6 (1.8) | b770 Gait pattern functions | 5 (1.5) |
| d475 Driving | 5 (1.5) | b780 Sensations related to muscles and movement functions | 6 (1.8) |
| d4751 Driving motorized vehicles | 5 (1.5) | s750 Structure of lower extremity | 7 (2.1) |
| d498 Mobility, other specified | 6 (1.8) | s75012 Muscles of lower leg | 7 (2.1) |

aPercentage of the 327 total extracted concepts. Comprehensive ICF Core Set Categories are in bold. Nomination frequency > 1 % of third level categories are demonstrated. ICF: The International Classification of Functioning, Disability and Health, PSFS: Patient-Specific Functional Scale

**Table 3.** Correlations between the PSFS scores and clinical outcomes.

| | NPRS (activity) | | ODI | |
|---|---|---|---|---|
| | rho | p | rho | p |
| PSFS item1 | -0.298 | 0.003* | -0.316 | 0.002* |
| PSFS item2 | -0.208 | 0.039* | -0.260 | 0.011* |
| PSFS item3 | -0.237 | 0.019* | -0.220 | 0.034* |
| PSFS average | -0.290 | 0.004* | -0.272 | 0.008* |

| | SF-36 Physical functioning | | SF-36 Pain | | SF-36 Social functioning | | SF-36 General health | |
|---|---|---|---|---|---|---|---|---|
| | rho | p | rho | p | rho | p | rho | p |
| PSFS item1 | 0.350 | 0.001* | 0.325 | 0.002* | 0.307 | 0.003* | 0.255 | 0.015 |
| PSFS item2 | 0.174 | 0.100 | 0.261 | 0.013* | 0.258 | 0.014* | 0.182 | 0.086 |
| PSFS item3 | 0.144 | 0.175 | 0.212 | 0.045* | 0.103 | 0.335 | 0.240 | 0.023* |
| PSFS average | 0.251 | 0.017* | 0.292 | 0.005* | 0.250 | 0.017* | 0.245 | 0.020* |

| | Finger to Floor Test | | Lateral Side Bending Test (right) | | Lateral Side Bending Test (left) | |
|---|---|---|---|---|---|---|
| | rho | p | rho | p | rho | p |
| PSFS item1 | -0.281 | 0.005* | 0.292 | 0.004* | 0.318 | 0.001* |
| PSFS item2 | -0.274 | 0.006* | 0.251 | 0.013* | 0.310 | 0.002* |
| PSFS item3 | -0.144 | 0.159 | 0.164 | 0.108 | 0.187 | 0.067 |
| PSFS average | -0.250 | 0.014* | 0.270 | 0.007* | 0.305 | 0.002* |

Spearman rho correlation analyses was used; *Significant difference (p<0.05); NPRS: Numeric Pain Rating Scale, ODI: Oswestry Disability Index, PSFS: Patient-Specific Functional Scale, SF-36: Health Related Quality of Life Short Form 36.

not in the LBP Core Sets: Purposeful sensory experiences (d129-0.3%), other specified and unspecified (d129-0.3%), undertaking multiple tasks (d220-0.9%), carrying out daily routine (d230-0.9%), carrying, moving and handling objects, other specified and unspecified (d449-0.3%), mobility, other specified (d498-1.8%). Considering that they were reported with low frequency and these differences were ignored, it can be inferred that the LBP Core Sets are useful for obtaining a gross overview of the activity and participation problems of Turkish LBP patients. However, Core Sets for LBP do not provide a specific description of the activity restriction such as bending, sitting, standing or walking. From this point of view, the use of core sets may not be sufficient for planning an individual treatment program. The results provide evidence of the prototypical problems of functioning in Turkish patients with long-lasting back pain. There is a need to extend the content of ICF Core Sets and the responses derived from PSFS may support the extension of the Core Sets. As to our knowledge, there are no currently available Turkish studies investigating the limitations of chronic LBP patients using the ICF framework, our results provide an evidentiary base regarding the cross-cultural validity of the Core Sets for LBP.

Ibsen et al. (2016) investigated whether patient-reported measures (PROMs) describe functioning in LBP patients and concluded that they do not cover experienced prototypical problems of patients as defined by the Brief Core Set [17]. They attributed this to the complex structure and imprecise nature of fixed-item PROMs and many of the items linked with more than one ICF category. The patient-specific scales have an advantage of addressing personal priorities at the individual level and provide patient-nominated items, unlike the fixed-item instruments. We used PSFS as a patient-specific instrument, and the most salient problems derived from PSFS were linked with the second and third-level ICF categories.

Maintaining body position (18.3%) was identified as the most frequently reported problematic function. Abbot et al., (2011) reported that the most stated expectation for rehabilitation after the lumbar fusion surgery was maintaining body position [18]. Similarly, Aartun et al., (2021) showed that maintaining body position was most often identified as problematic in LBP patients living in 3 different countries [19]. However, the frequency of other reported categories varied. This may result from the differences in lifestyle, habits, pain coping strategies, and cultural background.

In this study, 93.1% of PSFS responses were related to the activity and participation component of the ICF. Similarly, a retrospective study showed that PSFS responses of LBP patients were related to activity and participation components at a rate of 92.6%. However, it provides only an overview [7]. Hence, a detailed comparison between chapter and category cannot be made.

In the research investigating the psychometric properties of PSFS, PROMs were mostly used to construct validity criteria. A systematic review demonstrated that PSFS showed weak to strong construct validity with the different PROMs [20]. In a few studies, the correlations between PSFS scores and performance tests were investigated, but the evidence is scarce to generate the results. Gutknecht et al. claimed that PSFS may reflect the treatment success and confirmed that the change in PSFS score was correlated with the change of movement control impairment test in non-specific chronic LBP [21]. In another study, PSFS score change was not correlated with grip strength, but was in a relationship with change in perceived disability level in hand osteoarthritis patients [22].

We explored the relationship of the PSFS to clinical measures including both PROMs and physical tests in LBP patients. Significant correlations between PSFS and NPRS score during activity, ODI score, SF-36 pain domain, physical functioning and social functioning domains provide evidence that PSFS is able to evaluate activity limitations. Interestingly, TKS, HADS-A, HADS-D and SF-36 assess psychological variables, which are known as determinants of functioning, were not associated with the PSFS. This may be due to the activities stated by patients reflecting the most problematic activities they have to do in daily life, even if they have kinesiophobia or mood disorder. The finger-to- floor test, and lateral bending test results were in correlation with the PSFS score, which may be because the flexibility is more decisive in reflecting lumbar spine mobility and ability to participate and complete the activities. In contrast, the lack of relationship between endurance tests and PSFS may reflect that muscle endurance is not a predictor of activity restriction. Future studies are needed for more detailed information on this issue.

## Limitations

Because of the lack of subgrouping of patients, differences or similarities could not be drawn. Grouping patients based on the radiological or clinical features or assessments of the pain-free controls would reveal some mediating factors related with the activity limitations. Moreover, the measurements were not repeated over time. The changes in the clinical measures may reflect the changes in PSFS scores in a period or after a treatment program, even if no correlations were found in one-time assessment.

## Conclusion

Chronic LBP patients have reported various functional restrictions. The ICF core sets are useful to describe the problems of Turkish patients, but not sufficient to identify the specific problematic activity for planning individual tailored treatment programs. Some clinical outcomes reflect the activity restriction level, but not the content. PSFS has an advantage for addressing personal priorities.

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